

What is claimed is:

1. A separator-electrode unit comprising a porous electrode useful as an electrode in a lithium battery and a separator layer applied to this electrode, characterized in that the separator-electrode unit comprises an inorganic separator layer which comprises at least two fractions of metal oxide particles which differ from each other in their average particle size and/or in the metal, the separator layer comprising metal oxide particles having an average particle size (D_g) which is greater than the average pore size (d) of the pores of the porous electrode that are adhered together by metal oxide particles having a particle size (D_k) which is smaller than the pores of the porous positive electrode.
2. A separator-electrode unit according to claim 1, characterized in that the separator layer has a thickness (z) which is less than $100 D_g$ and not less than $1.5 D_g$.
3. A separator-electrode unit according to either of claims 1 and 2, characterized in that the separator layer has a thickness (z) which is less than $20 D_g$ and not less than $5 D_g$.
4. A separator-electrode unit according to at least one of claims 1 to 3, characterized in that the metal oxide particles having an average particle size (D_g) which is greater than the average pore size (d) of the pores of the porous positive electrode are Al_2O_3 and/or ZrO_2 particles.
5. A separator-electrode unit according to at least one of claims 1 to 4, characterized in that the metal oxide particles having an average particle

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size (D_k) which is smaller than the average pore size (d) of the pores of the porous positive electrode are SiO_2 and/or ZrO_2 particles.

- 5 6. A separator-electrode unit according to at least one of claims 1 to 5, characterized in that the metal oxide particles having an average particle size (D_g) which is greater than the average pore size (d) of the pores of the porous positive
10 electrode have an average particle size (D_g) of less than $10 \mu\text{m}$.
7. A separator-electrode unit according to at least one of claims 1 to 6, characterized in that the
15 separator layer comprises a further coating with shutdown particles which melt at a desired shutdown temperature.
8. A separator-electrode unit according to claim 7,
20 characterized in that the shutdown particles have an average particle size (D_w) which is not less than the average pore size (d_s) of the pores of the porous separator layer.
- 25 9. A separator-electrode unit according to either of claims 7 and 8, characterized in that the shutdown particle layer has a thickness (z_w) which ranges from about equal to the average particle size of the shutdown particles (D_w) up to $10 D_w$.
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10. A separator-electrode unit according to at least one of claims 1 to 9, characterized in that the separator layer has a porosity of from 30 to 70%.
- 35 11. A separator-electrode unit according to at least one of claims 1 to 10, characterized in that the unit is bendable down to a radius of 50 cm without damage.

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12. A separator-electrode unit according to at least one of claims 1 to 10, characterized in that the electrode is an electrode which is useful as a positive electrode (cathode) or as a negative electrode (anode).
13. A process for producing a separator-electrode unit according to at least one of claims 1 to 12, characterized in that it comprises forming a porous inorganic coating separator layer on a porous electrode substrate useful as a positive (cathode) or negative (anode) electrode in a lithium battery by applying a suspension which comprises metal oxide particles in a sol and solidifying the inorganic separator layer on the electrode by at least one thermal treatment, the suspension comprising metal oxide particles having an average particle size (D_g) which is greater than the average pore size (d) of the pores of the porous positive electrode.
14. A process according to claim 13, characterized in that, as the case may be, the metal oxide particles or the metal oxide particles having an average particle size (D_g) which is greater than the average pore size (d) of the pores of the porous positive electrode are Al_2O_3 and/or ZrO_2 particles.
15. A process according to either of claims 13 and 14, characterized in that the particles used as metal oxide particles have an average particle size of less than 3 μm .
16. A process according to any one of claims 13 to 15, characterized in that the suspension is applied to the substrate by printing on, pressing on,

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pressing in, rolling on, knife coating on, brushing on, dipping, spraying or pouring on.

- 5 17. A process according to at least one of claims 13 to 16, characterized in that the suspension used has a weight ratio of metal oxide particles to sol in the range from 1:1 000 to 2:1.
- 10 18. A process according to at least one of claims 13 to 17, characterized in that the suspension comprises at least one sol of the elements Al, Zr or Si or a mixture of these sols and is produced by suspending the metal oxide particles in at least one of these sols.
- 15 19. A process according to claim 18, characterized in that the sols are particulate sols.
- 20 20. A process according to claim 18, characterized in that the sols are polymeric sols.
- 25 21. A process according to any one of claims 18 to 20, characterized in that the sols are obtained by hydrolyzing at least one alkoxide compound of the elements Al, Zr or Si with water or an acid or a combination of these compounds.
- 30 22. A process according to at least one of claims 13 to 21, characterized in that the suspension has pyrogenic silica added to it to adjust the viscosity of the suspension.
- 35 23. A process according to claim 22, characterized in that the silica mass fraction of the suspension is in the range from 0.1 to 10% by weight.
24. A process according to at least one of claims 13 to 23, characterized in that the suspension

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applied to the electrode is solidified by heating to 50-500°C.

5 25. A process according to claim 24, characterized in that the heating is effected at a temperature of from 200 to 280°C for from 0.5 to 10 minutes.

10 26. A process according to at least one of claims 13 to 25, characterized in that the solidifying of the suspension applied to the electrode is followed by the application to the separator-electrode unit of a layer of shutdown particles which melt at a desired shutdown temperature to create a shutdown mechanism.

15 27. A process according to claim 26, characterized in that the layer of shutdown particles is formed by applying a suspension of shutdown particles having an average particle size which is greater than the
20 average pore size of the separator layer in a sol, water, solvent or solvent mixture.

25 28. A process according to claim 27, characterized in that the suspension of shutdown particles further comprises an adhesion promoter.

30 29. The use of a separator-electrode unit according to at least one of claims 1 to 12 in lithium batteries.

30. A battery comprising a separator-electrode unit according to at least one of claims 1 to 12.